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SUMMARY STATEMENT OF ACTIVITIES OF THE NATIONAL RESEARCH COUNCIL, 1936–1937

By Dr. **LUDVIG HEKTOEN**, Chairman, and Dr. **ALBERT L. BARROWS**, Executive Secretary

THE following brief account of certain of the operations of the National Research Council during the past fiscal year, 1936–37, is issued this fall, since the full account of the Council's work in its annual report will not be available until the publication of the Annual Report of the National Academy of Sciences next spring.

The organization of the Council gives it now about 240 members, with an additional group of about 785 committee members. There is a body of over 600 past members to whom the Council still turns on occasion for advice and assistance. The scientific and technical societies and institutions associated with the Council through representation in membership number 81, exclusive of the scientific bureaus of the Federal Government which are represented in the Council by Presidential appointment. On the calendar of the Council there were listed last year as in progress under special committees over 80 active projects of varying nature and significance. It will be possible at this time, however, to refer to but a few of these in the following paragraphs.

FELLOWSHIPS

This year has marked a change in the method of administration for the post-doctorate fellowships of the National Research Council, which have been supported since 1919 by funds provided by the Rockefeller Foundation. In order to effect economies of administration, two of the former boards of the Council representing the physical sciences and the biological sciences have been consolidated into a single board of five members, the National Research Fellowships Board in the Natural Sciences. The Medical

Fellowship Board, however, also of five members, will be maintained as formerly. The new fellowships board will continue the previous fellowships policy of the Council on substantially the same basis as heretofore, but, by special arrangement with the Rockefeller Foundation, will award fellowships in geology and physical geography as well as in chemistry, physics, mathematics, biology, anthropology and psychology. In the selection of fellows the new board will be assisted by special standing fellowships committees in the five technical divisions of the Council concerned, and these committees have been appointed so as to conserve the experience of the Council in the administration of fellowships.

Last spring the fellowship applications received totalled 173 by the National Research Fellowships Board in the Natural Sciences and 58 by the Medical Fellowship Board. From these the two boards made 14 reappointments and 35 new appointments for the academic year 1937–38. Of these appointments the total number in the medical sciences is 14. The prospect is that somewhat fewer appointments can be made for the following year, but the Council looks forward to the continuation of a considerable number of fellowships each year.

There are now over 1,100 past fellows of the Council. Of these about one quarter used their fellowships for study abroad and have returned to the United States. Over three quarters of all the past fellows are engaged in educational and research institutions. About five eighths of those engaged in academic work are already of professorial grade, and some of the students of these past fellows are themselves beginning to apply for fellowships. A number of past fellows of the Council have been recognized as outstanding scientific men through subsequent fellowship and research appointments, and through the receipt of prizes and awards.

GRANTS-IN-AID

The system of general grants in aid of research which the Council has maintained for the past eight years with funds supplied by the Rockefeller Foundation will be terminated with the current year, except that in the medical sciences there remains a sum of a few thousand dollars which will be available for the support of research on medical problems until the end of the calendar year 1937.

From these appropriations about 750 grants have been made for the individual support of research in sums averaging less than $600 each. About $30,000 has also been used for conferences during the period, and $15,500 for certain cooperative projects of the Council.

It is felt that this fund has served many useful purposes in meeting certain needs which were almost of the nature of an emergency, in augmenting and capitalizing other research resources so as to accomplish additional progress, in bridging gaps in which research projects might have lapsed or the interest of an investigator might have languished, and in lending assistance and encouragement to investigators by calling attention to the merit or promise of their work. However, a number of other funds from which grants in aid of research may be made are now available through other organizations, and in general the funds available for the support of research in this way are both larger than ever before and better known than formerly. This steady strengthening of the sinews of scientific work is a matter of deep gratification to the Council.

SCIENTIFIC AIDS TO LEARNING

Among the projects of the Council newly undertaken during the year is a study of the adaptation of certain modern scientific developments as aids to learning, not only in the formal educational system of the schools, but for purposes of adult education and for the reliable information of the public at large. Among these possibilities are the utilization of the radio both for schoolroom use and for public broadcasting; motion-pictures, with special reference to classroom instruction, field and laboratory observations and other uses; television; increased utilization of the phonograph in educational work; and improved forms of documentation. The possibilities for aiding the deaf and the blind by certain of these developments are also very great.

During the past 400 or 500 years the dissemination of knowledge has been mainly dependent upon the printed page, which in turn was a tremendous gain over the written and spoken word to which education as well as all forms of communication had previously been limited. The educational possibilities of these newer developments in science and technology seem to be almost immeasurable in the extension of the uses which have been made of printing. The adaptation of these mechanical devices, however, for the imparting of knowledge successfully and without waste seems to require thoroughgoing studies of the characteristics of these inventions, of their relationship to social usages and of the perceptive processes of the human mind.

Supported by funds from the Carnegie Corporation, the National Research Council has appointed a Committee on Scientific Aids to Learning, which has taken offices in New York City and which with the assistance of a director on full time will attempt to clarify the bases for the educational utilization of these scientific and technological aids and to formulate a program of investigations leading to their suitable and more extended use.

BORDERLAND PROBLEMS

For the past two years the Council has been interested in certain borderland problems lying "in between" the regular disciplines in the major fields of science. Two movements for the coordination of borderland research have resulted. One of these consisted of a series of conferences held by an interdivisional committee of the Divisions of Geology and Geography, Chemistry and Chemical Technology and Physical Sciences for the consideration of problems in the field of geology on which attack must be made by means of the methods of physics and chemistry. Several lists of borderland problems have been compiled relating to phase equilibrium, the deposition of minerals in the colloid state, radio activity, differential pressures, the physical constants of geological materials, rock deformation, hydrodynamics and geophysics. A statement of these problems recently published in SCIENCE (April 9, 1937, pages 361–362) invites advice and comment as to the further development of these problems as well as suggestions as to the location of facilities which can be brought to bear upon them. It is planned later to publish a more extensive report defining the status of a number of the problems as starting points for further investigations. A study has also been made of the problems common to the fields of physical geology, stratigraphy, paleontology and geography, which seem to have a particularly important bearing at this time. This summary has been published in mimeograph form.

The second general subject for borderland discussions was represented by a series of conferences held for the consideration of problems involving the life sciences, medicine, biology, anthropology and psychology. In these conferences it was suggested that in view of the growing concern over nervous and mental diseases, special attention be given to the subject of experimental neuroses as a critical point of attack in this field, with the result that plans are under way for the development of a program of coordinated work on certain basic problems of neurosis.

INTERNATIONAL RELATIONSHIPS

The National Research Council was represented this year at the triennial General Assembly of the International Council of Scientific Unions which met in London between the dates April 26 and May 4, 1937, by three delegates: Wallace B. Donham, dean of the Graduate School of Business Administration of Harvard University; Louis W. Hackett, of the Rockefeller Foundation, at present engaged in malaria investigations in Italy; and W. A. Noyes, Jr., professor of chemistry in Brown University.

One of the principal results of this meeting was the completion of a cooperative arrangement between the International Council of Scientific Unions and the Intellectual Cooperation Organization of the League of Nations, and a formal agreement covering this arrangement was signed by the presidents of these two bodies at a joint meeting of the Executive Committee of the International Council and the Scientific Experts Committee of the Intellectual Cooperation Organization in Paris on July 9 and 10.

Under this arrangement the International Council of Scientific Unions is to act as an advisory agency to the Intellectual Cooperation Organization of the League. The Intellectual Cooperation Organization is to consult the International Council on all scientific questions referred to it, and the Council is, in turn, to advise with the Intellectual Cooperation Organization upon all international questions affecting the organization of scientific work. A representative of each body will attend the major meetings of the other body. The International Council is to appoint committees in accordance with its usual procedures to study questions on which these two bodies are to collaborate. The manner in which practical work is to be carried out is to be determined in each case by mutual agreement, with the International Council remaining free to take such steps as it considers appropriate in any case in which the Intellectual Cooperation Organization does not act. The executive organs of the Intellectual Cooperation Organization will provide the secretariat for technical committees appointed under this agreement and will meet the cost of certain committee meetings. It is understood also that this cooperation is to be extended through the International Council to the several international unions affiliated with it.

At a joint meeting in Paris last July several matters of cooperation were considered, including a study of the scientific program of the Intellectual Cooperation Organization; steps for practical cooperation with the scientific unions in the appointment of coordinating committees and the publishing of reports of progress in the major fields of science; the preparation of scientific bibliographies, particularly for those languages not written with Roman characters; and the holding of "scientific conversations, the first of which will deal with the general consequences of deep alterations that have taken place in physics concerning the principles of the explanation of natural phenomena." The Scientific Experts Committee has also reviewed the program of the International Council and has studied several proposals recently received by the Intellectual Cooperation Organization, among which were a plan for the publishing of old scientific manuscripts and means for the coordination of investigations upon physical constants.

WASHINGTON BIOPHYSICAL INSTITUTE

This year it has been possible to carry into effect a plan proposed some years ago for the encouragement of quantitative studies in biology and the significance of physical phenomena in life, and the development of special apparatus for aiding such studies, involving also the adaptation of methods and instruments of research in the physical sciences for use in biological investigations. To this end the Washington Biophysical Institute has been set up in Washington, D. C., and has begun its operations supported in part by a grant from the Rockefeller Foundation and in part by substantial cooperation by the National Bureau of Standards and the National Institute of Health. The work of the Biophysical Institute at first is being directed toward the development of special apparatus, including a near-infra-red recording spectrometer with glass prisms, a salt prism infra-red spectrograph and auxiliary equipment for use with the standard ultra-violet spectrograph in quantitative absorption analyses.

EUROPEAN LABORATORIES TOUR

Under auspices of the Division of Engineering and Industrial Research of the Council a special tour was arranged this summer to enable industrial and financial executives of the United States to visit government, university and industrial laboratories in European countries. The party contained about twenty-five members. The visits were arranged through the courtesy of the Department of Scientific and Industrial Research in England, the Verein Deutscher Ingenieure in Germany and the Under Secretary of Scientific Research in France. Members of the tour have returned impressed by the strong momentum of scientific research in Germany under the stimulus of governmental directive and national esprit, the close and successful relations between the Government and industry in England in matters of research and the significance of the recent establishment of the office of Under Secretary for Scientific Research in the Department of Foreign Affairs in France and of the initial appropriation of 10,000,000 francs for the support of research under the supervision of this new office of the government.

FILMSLIDE INVESTIGATIONS

The work conducted for some years at the National Bureau of Standards, which has been supported by grants from the Carnegie Corporation and for which the Council's Division of Chemistry and Chemical Technology has maintained an advisory committee, changed in character last year after certain definite results had been reached in regard to the optimum conditions for the storage of library materials, and investigations were undertaken upon the deterioration of photographic film which is being used more and more for record purposes.

The Carnegie Corporation has continued to support this work, and funds have also been contributed by a number of manufacturing corporations. The rapidly increasing use of film for record purposes in libraries and by record agencies of many kinds intensifies the importance of these investigations. In this connection may be mentioned, also, the interest which the Council has had in the organization of the American Documentation Institute under the auspices of Science Service, which is to develop further the use of film for various types of recording and publication.

HIGHWAY RESEARCH

Since 1921 the National Research Council has been under contract with the Bureau of Public Roads to render services in the encouragement and coordination of research in the highway field. For this purpose the Council maintains a Highway Research Board which has numerous contacts with state highway commissions, with engineering departments in educational institutions and with corporations dealing in highway construction materials and road-making machinery.

The sixteenth annual meeting of the board was held in Washington, D. C., on November 19 and 20, 1936, with an attendance of over 400, representing various sections of the United States, and with delegates also from Canada and Mexico. Committee reports and research papers were presented at this meeting relating to highway design, materials and construction, highway maintenance, highway finance and administration, highway transportation economics and traffic surveys and traffic control. A special symposium was included upon soil stability as the basis of durable road construction.

In addition to the encouragement of work upon highway planning and construction, the Bureau of Public Roads last winter requested the Highway Research Board to undertake a study of highway safety and provided special funds for this purpose. A preliminary report was prepared for the bureau early in the summer upon the uniformity of state motor vehicle laws, the characteristics and habits of automobile drivers and means for identifying dangerous drivers, and improved methods of reporting accidents, which are fundamental to further study of accidents and their prevention. These studies are to be continued during the coming year.

ENDOCRINOLOGY

Last year the John and Mary R. Markle Foundation of New York requested the National Research Council to prepare a report upon the status of research in

endocrinology and the prospect for promising further investigation in this field. A special committee of the Council drew up a comprehensive and significant report on the present state of knowledge in endocrinology, and on the basis of this report the foundation has made an appropriation to the Council which will be available over a period of three years for the support of research on the physiology of the ductless glands.

The Council's Committee on Research in Endocrinology has recently awarded a portion of these funds in grants to some fifteen collaborators for the support of studies to be undertaken in cooperation with the institutions at which the grantees are located.

SEX RESEARCH

The Committee for Research in Problems of Sex has continued with strong momentum the program of research which it has been carrying forward for the past sixteen years, supported on funds supplied by the Rockefeller Foundation. For the past year this program has consisted of twenty-one projects conducted by collaborators at sixteen institutions. Many of these collaborators have been associated with the committee for several years and most of their projects will be included in the program of the committee for the coming year. The work of several former collaborators with the committee is now being supported directly by the Rockefeller Foundation or by other means.

Very great advances have been made in this subject during the period covered by the Council's committee. Not the least of the contributions in this advance which the committee may have assisted in making is felt to be the development at a score of institutions about the country of strong centers for research in this field. The collaborators with the committee have themselves published about 900 papers during this time. A second edition is being prepared this year of the volume compiled for the Committee in 1934 by Dr. Edgar Allen upon "Sex and Internal Secretions."

While in its earlier years the attention of the committee was directed mainly toward the physiological phenomena of sex and studies of the sex hormones, with the great impetus which endocrinology has now acquired it has seemed expedient for the committee to turn its efforts toward the less well-developed neural and psychological aspects of these problems.

DRUG ADDICTION

The investigations undertaken seven years ago upon the chemistry and pharmacology of narcotic drugs as a contribution toward a solution for the narcotic problem have been carried forward vigorously during the past year upon continued support from the Rockefeller Foundation. This work has been conducted under the direction of a committee of the Council in cooperation with the United States Public Health Service and the Department of Chemistry at the University of Virginia and the Department of Pharmacology at the University of Michigan. A large number of new drugs having similar chemical structures have been produced and their physiological properties have been studied. These are mainly derivatives of morphine, although a number of them have been synthesized from phenanthrene and other bases. Several of the more promising substances thus produced have been studied clinically to determine their analgesic potency and their habit-forming properties.

Most gratifying in connection with these investigations has been the generous cooperation of agencies in the federal and in state governments, and of manufacturers of pharmaceuticals, especially as a demonstration that such cooperation is possible and can lead successfully to results which are not obtainable in any other way.

PATENT POLICY

The work of the Council's Committee on Drug Addiction just mentioned is of special interest also as having led during the past year to the practical solution of one of the important administrative problems which the National Research Council has met involving the proper disposition of the patentable results of scientific work sponsored by the Council. The policy of the Council with respect to the possible patenting of results of work conducted under its auspices is "to dedicate to the use of the public, in such manner as the Research Council may deem most effective, the results of such discoveries as are made in the course of investigations conducted under the auspices of the Research Council."

In the development of new narcotic drugs it soon became evident that some form of control over their manufacture must be provided. To accomplish this it was felt to be essential to take out patents on dihydrodesoxymorphine-D and several other substances resulting from the work of the Council's committee, and in the United States it has been found possible to assign these patents to the government, thus effecting a control over them in this country, since these substances clearly come under the federal narcotic laws. In order to extend this control abroad, the Research Corporation of New York, at the request of the Research Council, has applied for patents in several countries.

There are certain substances also being developed by the committee which do not fall under the jurisdiction of the narcotic laws, but which, nevertheless, ought to be controlled as to standard and distribution in the interests of the public. Patenting these sub-

stances appears to be the only recourse, and the Council plans to assign to the Research Corporation or other suitable agency patents on such substances as should be thus controlled.

RADIATION RESEARCH

The Committee on Radiation for the past eight years has been encouraging research upon the biological effects of various types of radiation (x-rays, ultra-violet light, infra-red rays, radium emanations, etc.). It has been gratified in having been able to bring to bear in this field resources not only of appropriations from certain of the foundations, but also the loan or donation of apparatus and supplies, representing in the aggregate large amounts, from a number of instrument makers and manufacturers. These have been made available to collaborators at universities and research institutions, but in doing so the committee has followed the policy of not attempting to furnish continuing support of a given program of investigation indefinitely, but rather of expecting that institutional provision will be made for the continuation of promising programs of investigation after initial assistance from the committee. During the past year the committee has thus supported thirteen projects carried forward from the previous year and nine new projects, with grants of moderate amounts, and has also arranged for the loan by manufacturers of x-ray apparatus to investigators in ten or twelve cases and for the loan of radioactive substances.

A special enterprise of the committee has been brought to completion during the year in a scrutiny of the problem of mitogenetic radiation. The conclusion from the present study is in general that present methods fail to demonstrate positively the existence of mitogenetic emanations, and that further productive work in this field must depend upon the development of more sensitive instruments and perhaps new methods of approach. (A report upon these investigations has just been published by the Council as *Bulletin No. 100,* August, 1937.)

These examples present some account of the nature of the activities in which the National Research Council has been engaged, but it is recognized that whatever value there may be in any of these operations is really due to contributions of time and counsel and effort from the scientific men of the country themselves. The Council has provided merely a mechanism to enable these men to aid their common purposes. The operation of the mechanism is in the hands of those who wish to use it. The Council is deeply grateful to all the agencies that have contributed funds for its use and to all those individual scientists who have joined in carrying out the purposes for which the Council was created.

OBITUARY

DAVID HENDRICKS BERGEY

ON September 5, 1937, died David Hendricks Bergey, pioneer, scientist, scholar, teacher and friend. He was born on December 27, 1860, at Skippack, Pennsylvania. His early education was received in the public schools of Montgomery County. He went to a private school for several summers and then became a teacher in the public-school system. Dr. Bergey attended the West Chester Normal School for one session and Ursinus Academy for a term. In the spring of 1881, he began the study of medicine in the office of Dr. Samuel Wolfe, of Skippack, and in the fall of the same year he entered the Medical Department of the University of Pennsylvania. He was graduated from it in 1884, receiving the degrees of bachelor of science and doctor of medicine.

Dr. Bergey practiced medicine in North Wales, Pennsylvania, from June, 1884, to October 1, 1893. Then he began his long and faithful service to the University of Pennsylvania. On November 6, 1894, he was appointed Thomas A. Scott fellow in hygiene in the Laboratory of Hygiene of the university. During that year he received the degree of master of arts in science and philosophy from Illinois Wesleyan University. Dr. Bergey then served successively in the Laboratory of Hygiene as assistant in chemistry, 1895–96; first assistant, 1896–1928; director *pro tem* of the School of Hygiene and Public Health, 1928–29; director of the Laboratory of Hygiene, 1929–31, and director *pro tem* of the Laboratory of Hygiene, 1931–32.

In the School of Medicine of the University of Pennsylvania he was appointed assistant professor of bacteriology in 1903. In 1916 the degree of doctor of public health was conferred upon him by the university. From that time until his retirement on June 30, 1931, he served as assistant professor of hygiene and bacteriology, 1916–26; professor of hygiene and bacteriology, 1926–31, and director of the Department of Hygiene, 1929–31. He was recalled from retirement to become acting professor of hygiene for the school year 1931–32. Dr. Bergey also held the position of professor of hygiene and bacteriology in the Graduate School of the University of Pennsylvania, 1928–32.

His services at the university were interrupted during the world war while serving in the armed forces of his country from 1917–1919. He was appointed as a first lieutenant in the Medical Reserve Corps,

U. S. A., and was honorably discharged from active service with the rank of major. He served as chief of the laboratory staff at Fort Oglethorpe, Georgia.

Upon his permanent retirement from the University of Pennsylvania in 1932, Dr. Bergey became director of research in biology of the National Drug Company, of Philadelphia, and retained that position until the time of his death.

He belonged to a number of learned societies, among them the Philadelphia County, Pennsylvania State and American Medical Associations, the American Association for the Advancement of Science, the Society of American Bacteriologists (president in 1915), the Society of Natural History, the College of Physicians of Philadelphia, the Pathological Society of Philadelphia, the American Public Health Association, Association of Military Surgeons, Sigma Xi, the Society of Experimental Biology and Medicine, and he was a member of the Pennsylvania German Society. He was the founder of the Eastern Pennsylvania Chapter of the Society of American Bacteriologists.

His industry and sound scholarship are attested by a voluminous bibliography of his contributions to biology, hygiene and the genealogy of his own family. He contributed seventy-six papers and seven books. His papers cover a variety of subjects, to mention a few in the field of bacteriology, tuberculosis, typhoid fever, diphtheria, streptococci, bacterial classifications and the pedagogy of bacteriology. In the field of immunity there are papers on opsonins, phagocytosis, anaphylaxis and the results of his last researches, which were on tetanus toxoid. Besides these he contributed many additions to our knowledge of hygiene and sanitation. His text-book on the principles of hygiene passed through seven editions. His greatest contribution is "Bergey's Manual of Determinative Bacteriology," which has passed through four editions, with a fifth in press. One has only to read a few pages of the book to appreciate his mastership of details, thoroughness and scholarly judgment. In spite of his critics the volume stands as a great contribution to American bacteriology. Its acceptance everywhere as a basis for bacteriological taxonomy is, in itself, testimony to its enduring value.

As a teacher Dr. Bergey was meticulous in his explanation of bacteriological details; he was painstaking, conscientious and always scientifically honest. He could be firm and uncompromising when the occasion demanded. He was very modest and very humble. His loyalty to his chief, the late Dr. Alexander C. Abbott, was indeed noble, but, unfortunately, his own true worth and ability were often overshadowed by it. As a man among his associates Dr. Bergey was well beloved. He was always interested in the problems of younger men, fair and kindly in his criticism, generous in giving sound advice and enthusiastic in all progress.

He is survived by his wife, the former Annie S. Hallman, whom he married in June, 1884, and by his brother, Nelson H. Bergey, of Philadelphia.

America has lost a pioneer in the field of bacteriology and hygiene; he was one of the last of the great morphologists. His associates have lost a good friend. We shall miss his cheery smile, his kindly welcome and his generous help.

CARL J. BUCHER
HARRY E. MORTON

PHILADELPHIA, PA.

RECENT DEATHS AND MEMORIALS

DR. FRANCIS W. O'CONNOR, director of the department of tropical diseases at Columbia University and associate professor of medicine, died on October 3 at the age of fifty-three years.

SPENCER PRITCHARD HOWELL, explosives engineer of the U. S. Bureau of Mines at Pittsburgh, died on September 23 at the age of fifty-seven years.

DR. GRACE O. MCGEOCH (Mrs. John A. McGeoch), who received the doctorate of philosophy from the University of Chicago in 1936 and has done work in experimental, genetic and educational psychology, died at her home in Middletown, Conn., on September 5.

DR. J. R. AIREY, distinguished as a mathematician and until his retirement in 1933 principal of the City of Leeds Training College, died on September 16 in his seventieth year.

MISS A. LORRAIN SMITH, formerly of the British Museum (Natural History), known for her work in mycology, died on September 7 at the age of eighty-three years.

THE *Journal* of the American Medical Association states that plans are under way to create the Marriott Memorial Fund for Research in Pediatrics, in honor of the late Dr. Williams McKim Marriott, formerly professor of pediatrics and dean of Washington University School of Medicine, St. Louis. The following are members of a committee in charge of the project: Dr. Malvern B. Clopton, Dr. George R. Throop, Dr. Philip A. Shaffer, present dean of the medical school, Dr. Alexis F. Hartmann and Dr. Park J. White, Jr. In addition to the endowment, a portrait of Dr. Marriott will hang in the St. Louis Children's Hospital. The cost of the portrait will be paid from the principal of the fund, while the income from the remainder will be devoted to research in the field of pediatrics. Dr. Marriott served as professor of pediatrics at the university from 1917 to 1936 and as dean from 1923 to 1936.

SCIENTIFIC EVENTS

THE NEW BUILDING OF THE PHARMACEUTICAL SOCIETY OF GREAT BRITAIN

The British Medical Journal states that plans for the new home of the Pharmaceutical Society of Great Britain have been passed by the London County Council. Building operations will start shortly, and the society expects to enter into occupation in 1939. The site is the north side of Brunswick Square, within five minutes' walk of the British Medical Association House. It will be within a half-mile radius of the central tower of the university now approaching completion. The building will have six floors and will embody an assembly hall, library, lecture theaters, laboratory accommodation and classrooms, council chamber and committee rooms and full provision for the administration and publication departments, which are at present rather scattered in Bloomsbury Square. Chiefly with a view to harmonizing with the Victorian character of the new locality, the façades will be of brick, with an unusual and pleasing treatment of the principal frontage. To the right of the vestibule on entering will be the assembly hall, extending to the height of two floors and seating from 350 to 400 persons; to the left will be the library, also two stories in height, with embayments in which small tables for readers will be placed. Directly facing the vestibule will be a lecture theater, accommodating 250, with provision for up-to-date cinematograph and other demonstrations. This will be flanked on each side by an open court, permitting cross-lighting of the assembly hall and library. A members' lounge and writing room are also to be provided, and on an upper floor council and committee accommodation.

The Pharmaceutical Society incorporates a college, which is a school of the University of London in the Faculty of Medicine, with 100 students, and to this college will be devoted the whole of the third and fourth floors in the new building. There will be a large dispensary, departments for advanced and physical chemistry, bacteriology and research, a small-scale manufactory and a galenical department. Tutorial and service rooms, a second lecture theater, a curator's room, staff rooms and workshops will complete the provision for the school. Examination rooms are to be placed against the respective departments throughout. The top floor is to be devoted to pharmacological research, with a nutrition department, various animal rooms and histological and chemical laboratories. Another department for which provision is to be made is pharmacognosy, or the science of crude drugs.

EXPEDITION OF THE PHILADELPHIA ACADEMY OF NATURAL SCIENCES AND THE PEABODY MUSEUM

AN expedition to southeastern Asia, Java and the Philippines, sponsored by the Academy of Natural Sciences of Philadelphia and the Peabody Museum of Harvard University, left New York on October 6. Dr. Hellmut deTerra, associate curator of geology and paleontology of the Academy of Natural Sciences of Philadelphia and research associate of the Carnegie Institution of Washington, is in charge of the expedition. He will be accompanied by Dr. Hallam L. Movius, of the Peabody Museum of Harvard University. The party will proceed to the town of Mandalay in Northern Burma, which will serve as a base of field operations. Here, with the cooperation of the Burma Division of the Geological Survey of India, the expedition will search the gravels along the banks of the Irrawaddi River for fossils of prehistoric man and animals. Stone-age tools have already been uncovered in this region.

M. Pierre Teilhard de Chardin, co-discoverer of Pekin Man, will join the expedition in Burma on December 1, and with him two field trips will be made into the north above Myitkyina, which lies at the foot of the Chinese Alps, near the desolate wastes of Tibet.

From Burma, the expedition will travel by airplane to Singapore and Bandoeng, Java. There, joining forces with Dr. Ralph von Koenigswald, they will explore new sites along the Solo River, where last year Dr. von Koenigswald discovered the skull of a baby, probably the oldest skull in the world. As Java is extremely rich with evidence of both prehistoric man and the animals that lived contemporaneously with him, it offers an opportunity for the expedition to compare the age of early man there with finds in other parts of the world.

In the Philippines a survey will be made of the coastal plain near Manila that has been reported to contain fossils, which may possibly be identical with those associated with the remains of the Java and Pekin man.

Dr. deTerra will concern himself primarily with the geological sequences and stratigraphy, and Dr. Teilhard de Chardin with paleontology. Dr. Movius will direct the collection of archeological and anthropological specimens.

The expedition is a result of the discussion arising at the International Symposium on Early Man, held last March at the Academy of Natural Sciences of Philadelphia, in celebration of its hundred and twenty-fifth anniversary.

THE NATURAL SCIENCE MUSEUM OF SYRACUSE UNIVERSITY

THE task of restoring the Natural Science Museum of Syracuse University, which was partially destroyed in the Lyman Hall fire on January 11, is now under way and is expected to be completed by February 1 of next year. The museum is to be rebuilt and enlarged to serve primarily as a museum for instruction, not only for classroom purposes but for the education of the general public.

Although many valuable exhibits were destroyed or damaged in the January fire, much was saved and many additions to the collection have been made since the fire.

Dr. Ernest Reed, head of the plant science department in the university and leader of two South American expeditions, is at the head of the museum board, which is directing the work of rehabilitation. A director will not be selected until the task of restoration is complete.

Other members of the board are Dr. Earl T. Apfel, director of museum programs; Dr. Paul J. Sedgwick, director of the visual education program; Dr. Sidman P. Poole, director of publicity; Dr. Verlus Lindeman, chairman of the membership drive, and E. E. Thompson, university purchasing agent, in charge of maintenance and equipment.

Dr. Reed and W. B. Reid, of Rome, N. Y., who returned in April from the second Syracuse University Andean expedition in South America, have added a comprehensive collection of pottery, artifacts and photographs. Collections from this expedition will be arranged in a separate exhibit.

One of the most complete collections of non-metallic minerals known in science, a collection of several hundred bird skins and mounted birds and several mounted mammals were saved from the fire. The most valuable collection lost was the collection of metallic minerals gathered from mines throughout the world by Dr. Charles H. Richardson over a period of forty years. This collection included several thousand specimens.

FELLOWSHIPS OF THE LALOR FOUNDATION

THE Lalor Foundation has announced a program of five fellowship awards of $2,500 each which will be granted for the academic year 1938–39. Applications should be in the hands of the secretary, Dr. C. Lalor Burdick, Wilmington, Delaware, by December 31; appointments will be made in February, 1938.

The awards will be for research work in various fields of chemistry and related sciences. They may be used for work anywhere in the United States or abroad. However, as a memorial to the late Dr. Arthur A. Noyes, founder of the Research Laboratory of Physical Chemistry at the Massachusetts Institute of Technology, one of the awards will be specifically assigned to work at that institution. The trustees have established this series of awards to aid men of established competence working in fields of pure science, thereby laying needed emphasis on scientific endeavor of a fundamental character as distinct from industrial research and research in applied science.

Appointment is open to both men and women residents of the United States. No age limit is prescribed, but the usual range of ages will be between 22 years and 40 years. Men and women in academic service who are on sabbatical leave or other leave of absence are among those eligible for appointment. High intellectual and personal qualifications as well as creative ability and capacity for productive scholarship are essential elements in the appraisal of candidates. Except in unusual cases the minimum requirement for consideration for the award will be the attainment of the Ph.D. degree, or its equivalent, prior to the submission of application.

Five fellowships are being currently administered by the foundation, which was organized in 1935. The activities of the holders of present fellowship awards are in the fields of bioorganic chemistry, cryogenics, immunochemistry, photochemistry and radioactivity, and the institutions at which the researches are being conducted are the California Institute of Technology, the Imperial College of Science and Technology in London, the Johns Hopkins University, the Massachusetts Institute of Technology and the University of California.

The Board of Trustees of the foundation comprises: Dr. Charles Lee Reese, *president;* Hon. John P. Nields, Federal District Judge; Elwyn Evans, executive vice-president of the Wilmington Trust Company; Dr. C. Lalor Burdick, E. I. du Pont de Nemours and Company, all of Wilmington, Delaware; Mrs. Anna Lalor Burdick, U. S. Office of Education, Washington, D. C.; Henry Allen Moe, secretary of the Guggenheim Foundation, and Dallas S. Townsend, attorney, both of New York City.

THE NATIONAL ADVISORY CANCER COUNCIL

THE appointment has been announced by Dr. Thomas Parran, surgeon-general of the United States, with the approval of the Secretary of the Treasury, of six scientific men as members of the National Advisory Cancer Council. They will direct the activities of the newly established National Cancer Institute, a division of the National Institute of Health of the Public Health Service. Members of the committee are:

Dr. Arthur H. Compton, professor of physics at the University of Chicago.

Dr. James B. Conant, president of Harvard University, and formerly professor of organic chemistry.

Dr. James Ewing, director of cancer research at Memorial Hospital and professor of oncology at Cornell University Medical School, New York City.

Dr. Francis Carter Wood, director of the Crocker Institute of Cancer Research, Columbia University.

Dr. Clarence Cook Little, director of the Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Me., and managing director of the American Society for Control of Cancer.

Dr. Ludvig Hektoen, head of the department of pathology at the University of Chicago; chairman of the National Research Council.

Dr. Parran, surgeon-general, is *ex-officio* a member of the committee.

The bill authorizing the institute was signed by President Roosevelt in August. It calls for the sum of $750,000 for the erection of a building and an annual appropriation of $700,000 for research and for the purchase of radium. Its primary object is research into the causes and cures of the disease. In addition, grants-in-aid may be made to other organizations and radium will be loaned.

A building for the institute is to be erected at Bethesda, Md., on land given by the late Luke Wilson, of Washington. The director of the institute has not yet been appointed.

SCIENTIFIC NOTES AND NEWS

THE Eldridge Reeves Johnson Foundation Lectures of the University of Pennsylvania will be given during November by Dr. Irving Langmuir. The general subject of the lectures will be: "Monolayers and Multilayers and Their Application to Biological Problems." Previous Johnson Foundation lecturers have been: Dr. A. V. Hill, Foulerton research professor of the Royal Society; Dr. E. D. Adrian, fellow of Trinity College, Cambridge, Foulerton research professor of the Royal Society; Dr. Joseph Erlanger, professor of physiology, Washington University, St. Louis, and Dr. H. S. Gasser, director of the Rockefeller Institute for Medical Research, New York City.

DR. HANS VIRCHOW, professor of anatomy at the University of Berlin, celebrated his eighty-fifth birthday on September 10.

THE Wright Brothers Medal of the Society of Automotive Engineers has been awarded jointly to R. J. Minshall, John K. Ball and Fred P. Laudan, engineers of the Boeing Aircraft Company, for the best paper presented to the society on aerodynamics and related subjects. The medal, which was awarded for a paper on the design and construction of large aircraft, was presented at the meeting of the society held in Los Angeles on October 7, 8 and 9.

DR. JAMES M. MARTIN, of Dallas, Texas, at the recent meeting in Chicago, was elected president of the American College of Radiology.

ON the occasion of the opening assembly of the college, Dr. William E. Wickenden, president of the Case School of Applied Science, Cleveland, unveiled a portrait of Dr. Eckstein Case, cousin of Leonard Case, Jr., founder of the college. Dr. Case retired on July 2 from active duty as treasurer of the institution, completing fifty years of service.

AT the University of Pennsylvania, Professor J. R. Schramm has been made professor of botany and director of the department; Professor Rodney H. True has become professor emeritus, but remains director of the Morris Arboretum; Dr. Conway Zirkle has been promoted to a professorship. Promotions in the department of zoology include Dr. Edwin R. Helwig and Dr. Rudolf G. Schmieder, from the rank of instructor to that of assistant professor.

DR. GEORGE L. PELTIER, plant pathologist in the Nebraska Agricultural Experiment Station since 1920, has been transferred to the chairmanship of the department of bacteriology at the University of Nebraska. Dr. R. W. Goss, of the station, has been appointed plant pathologist, and Dr. J. H. Jensen, of the Puerto Rico Agricultural Experiment Station, will become associate plant pathologist.

INSTRUCTORS in the School of Medicine of the George Washington University have been appointed as follows: Dr. Robert Custis Grubbs, physiology; Dr. Gail Lorenz Miller, biochemistry; Dr. Edgar Deucher Griffin, psychiatry; Dr. Zigmond Meyer Lebensohn, neurology; Dr. Joel Norton Novick, oto-rhino-laryngology.

DR. G. E. F. LUNDELL, since 1917 associate chemist in the Division of Chemistry of the Bureau of Standards, has been appointed chief of the division to fill the vacancy created by the retirement last July of Percy H. Walker.

DR. D. I. ABRAMSON, formerly instructor in the department of physiology of the Long Island College of Medicine and Sutro fellow in cardiovascular research at Mount Sinai Hospital, New York, has been appointed director of the department of cardiovascular research of the Institute for Medical Research at the Jewish Hospital, Cincinnati.

A RESEARCH fellowship of $4,500 at the Iowa State College, provided by the Charles Pfizer and Company,

Brooklyn, N. Y., has been awarded to Dr. Edward A. Prill, instructor in chemistry and bacteriology at Coe College for a study of fermentation in the ripening of butter.

DR. TIMOTHY LEARY, Boston, medical examiner of Suffolk County, has been given a grant-in-aid by the Committee on Scientific Research of the American Medical Association for further study of atherosclerosis.

DR. H. M. O. LESTER, deputy director of the Sleeping Sickness Service, Nigeria, has been awarded a Carnegie grant for visits to the Congo, Tanganyika, the Southern Sudan and other parts of Africa to study methods of sleeping-sickness control.

DR. ALEXIS CARREL, a member of the Rockefeller Institute for Medical Research, returned to New York City on September 30.

DR. WILLIAM M. SMALLWOOD, chairman of the department of zoology of Syracuse University, has returned to the United States after spending three months in England and Scotland.

DR. RAYMOND PEARL, professor of biology at the School of Hygiene and Public Health of the Johns Hopkins University, who was last April elected Heath Clark lecturer at the University of London for 1937, sailed for Europe on September 30.

DR. WILLIAM M. MANN, director of the Zoological Park at Washington, D. C., has returned from a collecting expedition to the East Indies, bringing with him a large collection of animals for the park.

DR. GEORGE B. CRESSEY, chairman of the department of geology and geography at Syracuse University, left Moscow on September 9 for northern Siberia, where he will continue his studies of Asiatic geography. He is traveling under the auspices of the Northern Sea Route Administration. Earlier in the summer he served as geographic consultant in Moscow for the Soviet World Atlas and participated in the Siberian excursion of the International Geological Congress.

THE London *Times* reports that the German explorer, Herr Wilhelm Filchner, who was awarded the German national prize of $40,000 for art and science, recently crossed the Indian frontier after having been released from captivity by the Tungans (Chinese Moslems) in Chinese Turkestan. He has sent a message to Simla from Leh, Kashmir, stating that he and his companion, Herr Haack, were imprisoned in Khotan for seven months. The object of the expedition was the establishment of a chain of magnetic stations from Lanchow, in Kansu, to Khotan. As a result it will be possible to draw magnetic maps of these areas.

DR. CLIFFORD W. CHAPMAN, of Ottawa, who expected to occupy a position with the Chinese Government as pharmacologist in the National Health Organization at Nanking, has been unable to take up his work there on account of war conditions in China.

THE annual faculty address at the opening session of the School of Medicine of the George Washington University was delivered on September 22 by Professor Francis Randall Hagner, executive officer of the department of urology. Dr. Hagner spoke on "The Early History of the George Washington University School of Medicine." He was presented by Dean Earl B. McKinley, who recently returned from the Orient, where he made a study of tropical diseases.

DR. SELIG HECHT, professor of biophysics at Columbia University, will deliver the first Harvey Society lecture of the current series at the New York Academy of Medicine on October 21. He will speak on "The Nature of the Visual Process."

AT the opening of the hundred and thirteenth annual session of the Jefferson Medical College on September 20, the introductory lecture was delivered by Dr. George Russell Bancroft, professor of physiological chemistry and toxicology, on "Some Goals in Medical Study."

DR. CHEVALIER JACKSON, of Temple University, Philadelphia, lectured on broncho-esophagoscopy at the Fanny Blumenthal Clinic in the Children's Hospital of Paris, during the first ten days of September.

DR. E. C. DODDS, Courtauld professor of biochemistry at the University of London, will give on October 11, 12 and 13 the Harben lectures of the university. He will speak on "The Theoretical and Practical Significance of Endocrinology."

THE Harveian Oration before the Royal College of Physicians of London will be given on October 18 by Sir Arthur F. Hurst. He will speak on "Observation and Experiment and the Physiology of the Stomach."

A SOLVAY Chemical Conference on "Vitamins and Hormones" was held at Brussels from October 4 to 9. The speakers were: P. Karrer, H. von Euler, Ad. Windaus, W. N. Haworth, A. Szent-Györgyi, L. Ruzicka, E. Laqueur and T. Kögl.

THE twenty-seventh annual Clinical Congress of the American College of Surgeons will be held at the Stevens Hotel, Chicago, from October 25 to 29, under the presidency of Dr. Eugene H. Pool, of New York City. The annual college oration on surgery will be delivered by J. P. Lockhart-Mummery, of London, whose subject will be "The Surgeon as a Biologist."

Nature states that the third Prehistoric Congress of the Far East will take place at Singapore from Janu-

ary 24 to 29, 1938. Membership in the Congress is confined to delegates nominated by their respective governments or by scientific societies and institutions. Other anthropologists and prehistorians, however, will be allowed to attend the sessions as visitors and will enjoy the privileges of members, with the exception of the right to vote. The official languages which will be recognized are English, French and German. There is no subscription. Applications for invitation should be addressed to the Director, Raffles Museum, Singapore, Straits Settlements.

THE League of Nations Mixed Committee on the Problem of Nutrition appointed in September, 1935, has issued a detailed report. It urges governments to adopt a conscious nutrition policy by establishing national committees to ascertain food consumption habits and nutritional status in all sections of the population. Detailed evidence of malnutrition even in the most advanced countries is given in the report, which is intended to be used as a basis for a world nutrition policy during the next few years. The committee is made up of representatives of the Technical Commission of the Health Committee of the league, the International Labor Office and the International Institute of Agriculture. The United States was represented by Dr. Elmer V. McCollum, Baltimore; Dr. Edwin G. Nourse, of the Brookings Institution, Washington; Dr. Faith M. Williams, of the Department of Labor, Washington; Professor Warren C. Waite, Minneapolis, and Dr. Harold B. Rowe, of the Brookings Institution, Washington.

THE National Research Council has formed a committee for research in contact catalysis, of which Dr. Robert E. Burk, professor of chemistry in the Graduate School of Western Reserve University, is chairman. Other members are: Professor F. O. Rice, of the Johns Hopkins University; Dr. P. H. Emmett, recently of the Bureau of Chemistry; Dr. L. S. Kassel, expert on chemical mechanisms for the Universal Oil Products Company; Dr. L. F. Marek, recently head of the Department of Industrial Chemistry at the Massachusetts Institute of Technology, now with Arthur D. Little and Company; Dr. W. A. Lazier, in charge of catalytic research for E. I. du Pont de Nemours and Company, and Dr. E. C. Williams, formerly Ramsay professor of chemical engineering at the University of London, now vice-president in charge of research of the Shell Development Company, San Francisco.

THE University of Tennessee College of Medicine has established three fellowships in radiology. Fellows will receive their practical instruction in the department of radiology of the John Gaston Hospital, the municipal hospital of the City of Memphis. The hospital is newly equipped with modern radiological equipment and possesses an adequate supply of radium. Remuneration of fellows will be: for the first year, maintenance and $400; for the second year, maintenance and $600; for the third year, maintenance and $1,200.

A BEQUEST of $211,247, the amount of the residuary estate of the late William Campbell, Howe professor of metallurgy at Columbia University, has been made to the university for the establishment of a fellowship for the encouragement of scientific research.

BY the will of the late Louis Blaustein, of Baltimore, a foundation to be used for charitable, educational or research purposes without regard for religion, creed, race or locality, has been endowed with the sum of $500,000. It will be known as the Louis and Henrietta Blaustein Foundation, and will be established as a corporation which will be organized within ten months from the date of probate of the will and will be managed by a board to be appointed by the widow and three children. The will reads: "The trustees shall thereupon pay over to the corporation the fund referred to, and the corporation shall use and apply the income therefrom and parts of the principal as hereafter set forth, for the furtherance and development of such charitable, benevolent, recreational, hospital, infirmary, educational, scientific, literary, library, research or other similar purposes as the board of directors of the corporation in its absolute discretion from time to time determine, and under such conditions as it may determine. The income from the fund may be used or its principal; it may go for medical or sociological research, education, recreation or any other benevolent purpose; it may be spent in Baltimore or elsewhere."

A GRANT of $50,000 to provide for a three-year program of research on disease has been made to the University of Pittsburgh School of Medicine by the Westinghouse Electric and Manufacturing Company. Under the grant a study will be made at the university of the value of artificial fever as a weapon against rheumatism, arthritis, venereal disease, the common cold, influenza, heart diseases, tuberculosis and brain disorders. The announcement was accompanied by a statement that the Westinghouse Company will not participate in the research, and has agreed to make the results available to all medical authorities as a contribution to public health. The research program will include attempts to find facts relating to humidity and temperature in their effects on the body.

THE American Pharmaceutical Association has announced, according to *Industrial and Engineering Chemistry*, that it will install a new laboratory in the American Institute of Pharmacy in Washington,

with the hope that early in 1938 it will be in operation. The purpose will be to develop improved standards for official drugs and preparations, and there will be included a study of tests for identity and purity as well as the development and improvement of methods of assay. While the laboratory is planned primarily for the study of the problems of the National Formulary, the association hopes that means will be found whereby the Board of Trustees of the U. S. Pharmacopœia will be able to participate in the research program. For the time being, the management of the laboratory will be under the direction of a committee appointed by the council, and later an advisory committee may be established.

DISCUSSION

LOUIS PASTEUR'S PATENTS

THAT Louis Pasteur actually patented several of his discoveries is a fact little known. Attention is directed to these patents in view of the current interest in the question whether research workers should obtain patents for any industrial and commercial utilization of their discoveries.

The results of Pasteur's researches in the manufacture of beer were patented in at least four different countries—France, England, Italy and the United States. In the United States two patents were obtained, No. 135,245 for "improvements in the process of making beer," granted on January 28, 1873, and No. 141,072 for "improvements in the manufacture and preservation of beer and in the treatment of yeast and wort, together with apparatus for the same," granted on July 22, 1873.[1]

The earlier patent recites:

> Previous to my invention in the process of making beer it has been customary to permit the exposure of the "wort" —that is, the boiled extract of malt or other material seasoned with hop or other qualifying ingredient—to the action of atmospheric air. I have discovered that by contact in the usual way with air during the process not only is the quality of the beer produced much impaired, but also that a less quantity is made from a given amount of wort than can be otherwise produced.
>
> Based upon this discovery and the idea of performing the process of brewing without the presence in the wort of atmospheric air, my invention has for its object to produce a better quality and greater quantity of beer from the same quantity and quality of wort, and to afford a beer which shall also embody the quality of greater degree of unalterableness during time and changes of climate, etc., in transportation and use; and to these ends my invention consists in expelling the air from the boiled wort while confined in a closed vessel or closed vessels, and then cooling it by the application of sprays of water to the exterior of such vessel or vessels, as will be hereinafter more fully explained.

The patent describes in detail an apparatus for removing the air and replacing it with carbon dioxide, and the process of carrying out the brewing in this manner.

The second patent is directed to the production of pure yeast, free from "organic germs of disease." The specification describes the manner in which such yeast may be obtained and tested. For testing, a microscopic examination, as well as trial run with a small quantity of beer, is indicated, and in connection with the former the drawing shows the appearance of pure and contaminated yeasts under the microscope. The preservation of the pure yeast is also mentioned. The patent also describes an apparatus and a method for brewing beer with the pure yeast. Four claims are in the patent, claim 1 being for the method of obtaining pure yeast, claim 3 for a vessel for making the control run and claim 4 for the brewing apparatus. The second claim, which reads, "Yeast, free from organic germs of disease, as an article of manufacture," is unique in patents in respect to its subject-matter. A claim of this type would now probably be refused by the examiner, since it may be doubted that the subject-matter is capable of being patented.[2]

The applications for the two patents are signed and sworn to by Louis Pasteur, as required by law. The record in the Patent Office shows that the patents were granted without any difficulty.

The patents were never assigned, and no record of anything having been done with them has been found. In all likelihood no attempts to commercialize the inventions were ever made, in this country at least.

In France three patents were obtained: No. 91,941, June 28, 1871 (Series III, Vol. 1, c. 14, 3, pages 18–19); No. 92505, Aug. 21, 1871 (Series III, Vol. 1, c. 14, 3, page 20); and No. 98,476, Mar. 13, 1873 (Series III, Vol. 6, c. 14, 6, pages 2 to 4). In Italy two patents were obtained, one on April 8, 1872 (Series II, Vol. 3, No. 124, plate 37) and one on July 10, 1873 (Series II, Vol. 4, No. 339, plate 89). Two British patents are numbered 2225, Aug. 24, 1871, and 1106, Mar. 25, 1873. The subject-matter of each of the three groups of patents corresponds generally to the two United States patents.

P. J. FEDERICO

WASHINGTON, D. C.

[1] Copies of the United States patents can be obtained from the Commissioner of Patents, Washington, D. C., for ten cents each.

[2] See the decision of the United States Supreme Court in American Fruit Growers *v.* Brogdex, 283 U. S. 1, 1931.

CHONDRODYSTROPHY IN THE CHICK EMBRYO PRODUCED BY A MINERAL DEFICIENCY IN THE DIET OF THE HEN

THE report of Wilgus and coworkers[1] on the preventive action of manganese, aluminum, zinc and iron on the occurrence of slipped tendon (perosis) in young growing chicks, together with our observations of a number of chicks hatched with slipped tendon, led us to study the effects on embryonic development and hatchability of feeding a slipped-tendon-producing ration to laying hens.

Eggs from hens that had been fed such a ration for two months gave a hatchability of less than 10 per cent. Those embryos that were sufficiently developed before death for observation showed, without exception, very short legs and wings and "parrot beak." The few chicks that hatched, although having short legs, did not have slipped tendon. Another group of hens fed the same ration plus 40 ppm each of manganese and zinc, as the respective sulfates, and 100 ppm of iron, as ferrous ammonium sulfate, produced eggs giving good hatchability and all normal chicks. Embryos that died showed normal development of appendages and mandibles.

The eggs from the hens fed the slipped-tendon-producing ration contained much less manganese than those from the hens fed the same ration plus the mineral supplements indicated above. As a result of these analyses and of our studies[2] on slipped tendon, we were inclined to attribute this condition to a manganese deficiency. This was proved to be correct by the injection of 0.03 mgs of manganese directly into the albumen of such eggs just prior to incubation, which resulted in normal development of the embryos and in an increase in hatchability.

The metatarsi, tibiae and humeri of the chicks and 20–21-day embryos from the injected eggs were 52, 44 and 40 per cent. longer, respectively, than the same bones of those from the eggs which were not injected with manganese. The injection of .03 mgs of zinc into the albumen of the egg had no appreciable preventive effect on this disorder.

These findings may offer some insight into the mechanism which produces slipped tendon in the growing chick. Further studies on this problem are in progress. This work will be published in detail elsewhere.

MALCOLM LYONS
W. M. INSKO, JR.
KENTUCKY AGRICULTURAL EXPERIMENT STATION, LEXINGTON

[1] H. S. Wilgus, L. C. Norris and G. F. Heuser, SCIENCE, 84: 252, 1936.
[2] Unpublished data, Kentucky Agricultural Experiment Station.

HEAD MOVEMENTS IN BIRDS

IN a recent issue of SCIENCE[1] Austin H. Clark has advanced a theory as to the visual value of avian head movements which, to the writer's mind, appears quite untenable. Clark suggests that stereopsis results from the fusion of images perceived at the extremes of a vertical or horizontal movement, the image being "blotted out" (*i.e.*, centrally suppressed?) during the movement.

That suppression does occur during human ocular movements is well known to any one who has ever tried to see his eyes move in a mirror; but it is quite unsafe to assume that such suppression occurs in any animal during *head* movements as such.

Again, if the images at the extremes of a movement could be fused stereoptically, we should long since have had "stereomovies" made by printing alternately the frames from two films exposed simultaneously through lenses separated by the inter-pupillary distance. Many workers in visual phenomena get the notion of such "movies" and a few take the trouble to try it out; but few if any have bothered to mention their failure in print.

The vertical and horizontal head movements of birds, and probably also the nodding movements of certain lizards, can aid in the judgment of distance only by the principle of parallax, as does the process of "rapid peering" to which Clark alludes. *All* the advantages of binocular vision are afforded only by binocular vision.

GORDON L. WALLS
DEPARTMENT OF ANATOMY
WAYNE UNIVERSITY

DRIFT BOTTLES RELEASED OFF COAST OF SOUTHERN CALIFORNIA

SIX thousand drift bottles have been released off the coast of southern California from the research vessel *Bluefin* by the State Fisheries Laboratory of the California Division of Fish and Game in an effort to trace the drift of the pelagic eggs and larvae of the California sardine. A cooperative program was undertaken by the laboratory and the Scripps Institution of Oceanography to make a study of surface currents during the spring of 1937 in the waters between Point Conception and San Diego, the major spawning region of the sardine. The drift bottles were prepared and released by the Fisheries Laboratory, and water samples and the subsequent dynamic computations were made by the Scripps Institution.

The bottles were twelve-ounce wine bottles, corked, sealed and ballasted with sand. Each bottle contained the usual "break the bottle" label, a sheet of instructions and a return post-card. Although most of these

[1] A. H. Clark, SCIENCE, 86: 223–224, 1937.

bottles have been out only a very short time, 150 have already been recovered. The longest drift so far recorded is that of a bottle released off Port San Luis, California, and recovered by a fishing vessel at Guadalupe Island, Lower California, thirty-eight days later. This bottle had traveled some four hundred miles at an average speed of about ten miles per day.

CALIFORNIA STATE FISHERIES LABORATORY
TERMINAL ISLAND, CALIF.
RICHARD B. TIBBY

SCIENTIFIC BOOKS

Atomic Spectra and the Vector Model. By A. C. CANDLER. 2 vols.: Vol. I, vi + 237 pp., 4 plates; Vol. II, 279 pp., 4 plates. Cambridge: at the University Press. New York: The Macmillan Company. 1937. Set $8.50.

THE quantum-mechanical interpretation of the nuclear atom-model, in a fairly satisfactory state at the present time, has been presented in a number of treatises of varying simplicity. Such volumes are entirely adequate for those research workers and students who possess the necessary mathematical background. There is, however, a group of physicists and astrophysicists who prefer an account in terms of an easily visualized model. For such a treatment, Fowler's *Report* and Hund's *Linienspektren* are no longer adequate, since their notations are now antiquated, and since there have been a host of new developments in the realm of atomic spectra during the past decade.

To meet the needs of practical workers in the field, Mr. Candler has presented the work of Fowler and of Hund from the standpoint of the vector model, using modern notation, and with the inclusion of much of the more recent work on atomic spectra. The keynote of the presentation is simplicity and complete freedom from mathematical complexity. There are copious references to the results of laboratory investigations; these results are freely compared with vector-model expectations, and frequent comparisons are made with the predictions of quantum mechanics.

Volume I deals with series in line spectra, particularly with the important researches of Fowler, Millikan and Bowen, and Landé on the spectra of the alkali doublets and alkaline earths. The treatment of Zeeman and Paschen-Back effects is fairly complete and is recommended for its clarity and simplicity. Two short chapters on "Atomic Magnetism" and the Stark effect are followed by a detailed account of the ordering of the elements in the Periodic Table, and the explanation in terms of electronic structures and the Pauli exclusion principle.

Volume II describes the results of laboratory analyses of complex spectra and their vector-model interpretation. There is a useful description of the methods of coupling the various electrons of a configuration to yield the resultant set of terms, and a comparison of Hund's empirical rules with the observational results from the short and long periods of the elements. In addition the author describes the intensity measurements of Ornstein and Burger, Harrison and others on the lines of complex spectra, and the theoretical intensity relationships in multiplets and supermultiplets. The volume is concluded by a not too up-to-date discussion of Hund's limits, and by chapters on hyperfine and nuclear structure, quadripole radiation and fluorescent crystals.

It is to be regretted, in view of the potential usefulness of a work so free of mathematical techniques, that so many errors and omissions occur throughout the two volumes. It is perhaps difficult to avoid a good many typographical errors in a first printing, but the numerous incorrect statements that are present are more serious. To mention a few of the most objectionable ones: in volume II, p. 136, the author makes the statement that intermediate coupling has no advantage over the simpler jj coupling in accounting for "abnormal" spectra. To say that jj coupling is "the only alternative to that postulated by Russell and Saunders," even for purposes of simplification, is to exhibit a total disregard for the good agreement with experiment achieved by Shortley and others in calculations based on the theory of intermediate coupling. In the chapter on quadripole radiation, one reads that all violations of the Laporte parity rule are due to quadripole transitions. There is no mention of magnetic dipole radiation, which quite frequently violates the Laporte rule. In the chapter on "Intensity Relations," it is stated that the simple Kronig formulae "should compare the intensities of any two lines arising in a transition from one configuration to another. . . ." The formulae by themselves are applicable *only* to lines within a multiplet. Also, it seems strange that nothing is said concerning the recent work of Shortley, Condon and Ufford, Johnson and others in deriving formulae for the relative strengths of multiplets in a transition array in LS coupling. There are occasional lesser errors. It is puzzling to read that "More than a century ago Fraunhofer named a number of dark lines which Newton had noticed in the spectrum of the sun." Wollaston was the first to call attention to the dark lines in 1802. There is no evidence that Newton ever observed more than the continuous spectrum.

Viewed broadly, Mr. Candler's work will be welcomed by those who wish to see the results of physical investigations expressed in simple language, unham-

pered by a maze of mathematical symbols. To accomplish such a feat of simplification in the interpretation of atomic spectra is not a simple task, and the author is to be commended for the facility with which he carries through his plan.

LEO GOLDBERG

HARVARD OBSERVATORY

AN APPEAL FOR MATHEMATICAL UNDERSTANDING

Mathematics for the Million. By LANCELOT HOGBEN, F.R.S., London School of Economics. Illustrations by J. F. Horrabin. W. W. Norton Company, Inc., New York. xii + 647 pages. $3.75. 1937.

THE title might suggest that here is another "mathematics made easy," a short-cut course in technical tricks for the apprentice computer. On the contrary, this is a reasoned appeal for common sense and understanding on the part of educated readers for the application of the mathematical discoveries of the race toward the solution of present-day problems. The earlier British edition stirred wide interest. For the wealth of historical and social contacts, for the pervasive philosophical motivation, for the breadth of sympathy and vigor of attack upon entrenched apathy this book is outstanding. It is not designed to inform the specialist, since it contains little material on pure mathematical theory with which any competent instructor in college mathematics is not already familiar. No brief list of its twelve chapters can do the work justice. Perhaps the most unusual are Chapter III—"The Grammar of Size, Order and Number, or Translating Number Language," and Chapter XII—"Statistics or the Arithmetic of Human Welfare," which strike notes that traditional text-books seldom suggest. Undoubtedly even the little mathematical technique assumed will discourage or repel many scholarly persons. Yet the lively, informative and gracious style and suggestive illustrations will maintain the average reader's interest through its six hundred and fifty pages, leaving him eager for more, and thrilled with a new sense of the power and flexibility of mathematics as a method of thinking.

ALBERT A. BENNETT

SPECIAL ARTICLES

DIGITALIS AND CALCIUM SYNERGISM[1]

EXPERIMENTS were published by Gold and Edwards[2] in 1927, which showed that hypercalcemia resulting from the injection of calcium chloride or the parathyroid hormone rendered the normal dog more susceptible to the action of ouabain. This was confirmed by the experiments of Lieberman[3] in which another digitalis glucoside and calcium gluconate were used. That digitalis and calcium act synergistically in animal experiments has been known for a long time and observations have been published indicating a similar phenomenon in man (review of literature, Berliner, 1933).[4] Bower and Mengle[5] reported two cases in which patients under the influence of digitalis died after an intravenous injection of calcium gluconate. They ascribed this to synergism between the two drugs and performed experiments in dogs which led them to the same conclusion. Their animal experiments, however, are not very convincing because of the large doses of digitalis they injected, although their conclusions are in accord with the work of others.

A discordant note is struck in a more recent report by Nahum and Hoff,[6] who tested the effect of intravenous calcium chloride in rabbits which had received digitalis in the form of digifoline. A careful examination of their paper, however, shows that in those animals in which no additive effect was observed, there is reason to believe that the animals were no longer under the influence of digitalis, and furthermore, in those in which there is reason to believe that the animals were under the influence of digitalis, a very strong synergistic effect with calcium may have been present.

Two significant facts which Hatcher[7] demonstrated in 1912 appear to have escaped consideration, namely, (1) that the rabbit excretes digitalis with extraordinary rapidity and (2) that the rabbit is very tolerant to digitalis. In the experiments which we performed (see Table I), it was found that approximately three to seven times the largest doses of digitalis used by Nahum and Hoff were excreted completely or almost so within less than eight hours (experiments 4 and 5). It must be concluded therefore that in the eighteen rabbits in which these authors observed no additive action between digitalis and calcium, there was little or no digitalis present, because the dose (0.5 to 0.75 cat unit per kgm subcutaneously) was administered eighteen hours prior to the calcium, and the probability is that during that period most or all of it was excreted.

Another group of their animals was treated in a somewhat different manner. In addition to the subcutaneous dose of digitalis eighteen hours previously, they received a dose of 0.25 cat unit per kgm intravenously one half hour before the calcium. This treat-

[1] From the Department of Pharmacology of Cornell University Medical College, New York.

[2] H. Gold and D. J. Edwards, *Am. Heart Jour.*, 3: 45, 1927.

[3] A. J. Lieberman, *Jour. Pharmacol. and Exp. Therap.*, 47: 183, 1933.

[4] K. Berliner, *Am. Heart Jour.*, 8: 548, 1933.

[5] J. O. Bower and H. A. Mengle, *Jour. Am. Med. Assn.*, 106: 1151, 1936.

[6] L. H. Nahum and H. E. Hoff, *Proc. Soc. Exp. Biol. and Med.*, 36: 860, 1937.

[7] R. A. Hatcher, *Arch. Int. Med.*, 10: 268, 1912.

TABLE I

FATAL DOSE AND PERSISTENCE OF ACTION OF TINCTURE DIGITALIS IN RABBIT

Rabbit no.	Weight kgm	Period of injection min.	M.L.D.* mgm per kgm	M.L.D. cat units	Remarks
1	2.89	106	730	8.58	
2	2.98	61	408	4.8	
3	2.28	95	802	9.4	Received 1.5 cat units per kgm (specimen A) daily for two days; on third day a similar dose 8 hours prior to final testing.
4	2.57	95	708	8.3	Received 2.5 cat units per kgm (specimen A) 8 hours prior to final testing.
5	3.07	93	650	7.6	Received 1.5 cat units per kgm (specimen A) daily for two days; on third day 5.5 cat units per kgm (specimen B) in two doses 5 to 7 hours prior to final testing.
6	2.08	..	...	3+	Survived 3 cat units per kgm (specimen B) in one injection.
7	2.92	..	...	4–6	Received 4 cat units per kgm (specimen B) in one dose and 2 cat units per kgm in a second injection 5 minutes later; caused death with ventricular fibrillation.

* All these tests were made with specimen B, a tincture of digitalis with a cat unit potency of 0.85 cc. Specimen A was a tincture of digitalis with a cat unit potency of 0.75 cc. All injections were made intravenously. The doses in the table refer to the leaf.

ment caused the death of three of the five animals in four hours. These doses are extremely small for the rabbit. In our experiments (see table) the M.L.D. for the albino rabbit proved to be about eight times as much as that for the cat by the same method of slow intravenous injection.[8] Sudden intravenous injections of three and four units per kgm did not prove fatal. Accordingly, the subcutaneous doses which Nahum and Hoff gave eighteen hours prior to the calcium and which they referred to as 50 to 75 per cent. of the "calculated lethal dose" of digitalis, were in fact only about 6 to 9 per cent. of the lethal dose for the rabbit, and the additional intravenous doses (0.25 cat unit per kgm) were only about 3 per cent. of the lethal dose for the rabbit. In view of the rapid excretion of digitalis in the rabbit, the dose which proved fatal to three of five animals was only about 3 per cent. of the intravenous fatal dose when the animal was treated with calcium in the manner of their experiments.

Such facts constitute the standard evidence for the phenomenon of synergism. But the authors conclude: "In the normal unanesthetized rabbit heart the effects of calcium and digitalis are not additive." In view of the unusually high degree of synergism shown by the death of these three rabbits and the long interval before death, confirmation of these experiments would be desirable.

As matters stand, the synergism between calcium and digitalis remains an established fact. From the practical standpoint it needs to be borne in mind that the rapid intravenous injection of calcium is a dangerous procedure, and that the danger is greater when the subject is under the influence of digitalis.

HARRY GOLD
NATHANIEL KWIT

[8] The tincture of digitalis with the alcohol evaporated off was diluted five times with physiological salt solution and administered slowly intravenously so as to complete the injection in about ninety minutes, a method similar to that used in the cat method of assay.

THE pH STABILITY RANGE OF THE ELEMENTARY BODIES OF VACCINIA

THE causative agents of known virus diseases range in size from the elementary bodies of the pox diseases, which are almost as big as the smaller microorganisms, downwards to particles comparable in weight with the larger protein molecules. Since it is now possible to obtain concentrated and purified preparations of both large and small virus particles, a comparison of their properties becomes one of the most immediately interesting problems in the study of viruses. Recently[1] we reported preliminary results of a comparison of the pH stability ranges of the virus activity of infectious papillomatosis in rabbits and of the molecules of the purified virus protein[2] of this disease. In this investigation it was found, by animal titration and by ultracentrifugal analyses, that the protein molecules were disrupted at exactly those pH's at which the virus activity was immediately lost. The present note records the results of a similar comparison of the pH stabilities of the virus activity of vaccinia and of its purified elementary bodies.

The vaccine virus employed was obtained as calf lymph from the North Carolina State Board of Health. This virus was passed repeatedly through rabbits by the methods of inoculating and harvesting described by Craigie.[3] The destruction of virus activity was determined by suspending the virus in 0.04M salt buffer mixtures and inoculating the suspensions intradermally into susceptible rabbits after standing in the buffer for an hour, a day and a week. The actual pH of each suspension was measured with a glass electrode. The resulting lesions were charted daily for eight days after inoculation. Three experiments of this kind yielded practically identical results.

[1] R. W. G. Wyckoff and J. W. Beard, *Proc. Soc. Exp. Biol. and Med.*, 36: 562, 1937.

[2] J. W. Beard and R. W. G. Wyckoff, SCIENCE, 85: 201, 1937.

[3] J. Craigie and F. O. Wishart, *Brit. Jour. Exp. Path.*, 15: 390, 1934; etc.

The findings showed that the activity of the virus is preserved for at least a week at all pH's between 5 and 9.5, that inactivation proceeds rapidly at pH 4 and pH 10.5 and is practically instantaneous at pH's below 3 and above 11.5.

Elementary bodies, pure and concentrated enough for ultracentrifugal analysis, were obtained after several passages of the virus in rabbit skin. The ultracentrifuge was the same air-driven machine[4] arranged for absorption measurements that has been used in previous studies. Photographs of the rates of sedimentation of products of the first few passages starting with calf lymph showed no sharp boundary characteristic of particles of uniform size. Instead the pictures gave evidence of much heavy colloidal and light "unsedimentable" ultra-violet-absorbing material. After these preliminary passages, however, a sharp sedimenting boundary with a constant of ca $5{,}000 \times 10^{-13}$ cm sec^{-1} dynes^{-1} could be seen. At first the homogeneous matter was accompanied by colloidal and "unsedimentable" substances, but after two or three additional passages and minor improvements in the technique of washing the bodies, the ultracentrifugal pattern was that of a pure homogeneous suspension. Smears stained according to the method of Morosow[5] then showed little material other than numerous elementary bodies of uniform size. Undoubtedly the particles giving the sharp ultracentrifugal boundaries are those that serve as nuclei for the stain.

Both infectivity tests and the results of ultracentrifugal analysis indicate that solutions or suspensions of the elementary bodies of vaccinia are stable only in very dilute salt solutions. If fresh elementary bodies in 0.005M buffer are washed two or three times with distilled water, their final suspension no longer produces a good boundary. Some of the elementary bodies are injured by the agglutination that accompanies this washing. This is shown by the fact that resuspension in 0.005M buffer gives both a weaker and a more diffuse boundary. The homogeneity of elementary body suspensions in 0.1M neutral buffer rapidly disappears. After a few days in the cold such a suspension will no longer yield a sharp boundary in the ultracentrifuge nor can one be recovered by resuspension in 0.005M buffer.

Because of this sensitivity to strong salt, the suspensions for ultracentrifuging at different pH's were in 0.005M buffers. At all pH's between 5.5 and ca 10 suspensions of the elementary bodies are stable for days and give sharply sedimenting boundaries with $s_{20°} = \text{ca } 5{,}400 \times 10^{-13}$ cm sec^{-1} dynes^{-1}. At pH's between 3 and ca 5.5 agglutination is so nearly complete that sedimentation pictures show nothing. A boundary is again poorly discernible at pH 2.6 and good photographs can be obtained at pH 1.2. The boundaries in these acid solutions are more diffuse than those from active preparations and correspond to a substance that is perhaps 15 per cent. lighter. Further evidence of decomposition in the inactive acid suspensions is the fact that the quartz windows of the analytical cell become covered with a waxy deposit which interferes with the ultra-violet transparency of the air bubble. The decomposition in strongly alkaline solution is even more interesting. No trace of the sharp boundary with $s_{20°} = 5{,}400$ could be found in a suspension brought to pH 11.8. In its place was much unsedimentable material and a faint but fairly sharp boundary coming down more slowly. Some of the substance causing this boundary was isolated with the quantity ultracentrifuge. In pure solution it gives excellent sedimentation photographs corresponding to $s_{20°} = \text{ca } 1900 \times 10^{-13}$, a value about one third that of the active elementary bodies.

These experiments bring out a general parallelism between the stabilities of the virus and of the elementary bodies. The sedimentation constant of the bodies is uninfluenced by pH in that region where the activity is unaffected. In inactive acid and alkaline solutions the elementary bodies are broken down, leaving fragments some of which are very large and of a degree of homogeneity that compares well with that of the active bodies. The many similarities between these results and those obtained with the papilloma protein are evident.

A further study is being made of the properties of these inactive degradation products and of the loss of virus activity in the especially instructive range between pH 9.5 and 11.5.

J. W. BEARD
HAROLD FINKELSTEIN
DEPARTMENT OF SURGERY
DUKE UNIVERSITY MEDICAL SCHOOL
AND HOSPITAL
DURHAM, N. C.

RALPH W. G. WYCKOFF
ROCKEFELLER INSTITUTE FOR
MEDICAL RESEARCH
PRINCETON, N. J.

[4] J. Biscoe, E. G. Pickels and R. W. G. Wyckoff, *Jour. Exp. Med.*, 64: 39, 1936; R. W. G. Wyckoff and J. B. Lagsdin, *Rev. Sci. Instr.*, 8: 74, 1937.

[5] Morosow, *Centralbl. f. Bakt. I Orig.*, c: 385, 1926.

REDUCTION OF THE METHYL ESTER OF 2:3:4-TRIMETHYL α-METHYL-d-GALACTURONIDE TO 2:3:4-TRIMETHYL α-METHYL-d-GALACTOSIDE

IN order to facilitate the analysis of the structure of the derivatives of uronic acids (such as pectins, aldobionic acids, etc.), it seemed desirable to convert the

carboxylic groups of the latter into —CH_2OH groups and thus to transform the uronic acid into a simple monose.

This has now been accomplished in the case of *2:3:4-trimethyl α-methyl-d-galacturonide methyl ester,* which was reduced to 2:3:4-trimethyl α-methyl-d-galactoside. The reaction has been accomplished both by the methods of classical organic chemistry (described by P. A. Levene and L. C. Kreider in an article now in press) and also by the catalytic method, with the aid of copper chromite catalyst in an atmosphere of hydrogen.

The reduction was practically complete. The distilled product (a syrup which crystallized) had the following composition:

Found C 50.98, H 8.6, OCH_3 52.75. ($C_{10}H_{20}O_6$ requires C 50.81, H 8.6, OCH_3 52.55.)

It had $[\alpha]_D^{25} = +198.4°$ (in water); $n_D^{25} = 1.4626$ and m.p. $\simeq 30°$.

On hydrolysis the substance yielded 2:3:4-trimethyl d-galactose having m.p. 78–79° and $[\alpha]_D^{25} = +147°$ (initial in water); +120.4° (equilibrium).

Work in the same direction on aldobionic acids is now in progress.

P. A. LEVENE
R. STUART TIPSON
LEONARD C. KREIDER

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, NEW YORK

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE PRESERVATION OF BIOLOGICAL SPECIMENS BY MEANS OF TRANSPARENT PLASTICS

IN the September 10 issue of SCIENCE, on page 247, Dr. J. H. Hibben published a brief paper on the preservation of biological specimens by means of transparent plastics, in which he disclosed that the idea of imbedding various specimens in methyl methacrylate occurred to him some months before the submission of his manuscript for publication.

In view of the appearance of Dr. Hibben's paper and of certain statements contained therein, it seems desirable to point out that the Bureau of Chemistry and Soils, U. S. Department of Agriculture, has under way a Bankhead-Jones Special Research Fund Project dealing with the preservation of agricultural specimens in as natural a condition as possible. This project, which is under the direct supervision of Dr. Charles E. Sando, senior biochemist in the Food Research Division, consists of studies on the preservation of fresh plant materials such as roots, stalks, stems, leaves and flowers, and studies on the preservation of plant and entomological specimens in polymerized methyl methacrylate.

One process has been studied for many years by Mr. G. R. Fessenden and its further development and improvement are being continued by him in this bureau. It consists essentially in chemically treating fresh plant materials in such a manner as to toughen the tissues and set the natural color, after which the specimens are preserved in transparent mountings. Specimens so treated retain practically the same size, shape and color of fresh material and are therefore to be considered more or less permanent, although considerable research is necessary to make the process reasonably inexpensive and universally applicable. Mr. Fessenden's finished specimens have been exhibited at the Harvard Botanical Museum, the New York Botanical Garden, the American Museum of Natural History, the Buffalo Museum of Science, the Pennsylvania State Museum, Morton Arboretum and other museums, libraries and horticultural organizations, where they have created marked interest and much favorable comment.

The second phase of the special project dealing with the preservation of agricultural specimens, namely, that dealing with the imbedding in methyl methacrylate, was first begun in November, 1936, by Mr. F. L. Goll, of the Bureau of Plant Industry, at the request of Dr. F. W. Parker, of E. I. du Pont de Nemours and Company, Wilmington, Delaware, and was later modified and improved by Dr. Sando, working in close cooperation with the Bureau of Plant Industry and with Dr. D. S. Frederick, of Rohm and Haas Company, Philadelphia, Pa. The most intensive research on the methyl methacrylate method has been in progress since May, 1937. As a result of such work many difficulties have been overcome, and nearly forty unusually fine specimens have been prepared, including seeds, certain flowers, beetles and iridescent butterflies. The largest of these specimens is an ear of corn which in its imbedded state measures $2\frac{1}{4}'' \times 3'' \times 7''$ and weighs approximately $1\frac{3}{4}$ pounds. These specimens have all been machined and polished and are therefore finished mounts.

One is apt to draw the conclusion from Dr. Hibben's paper that mounting biological materials in methyl methacrylate is a relatively simple and easy matter and that polymerization will take place in a matter of hours. The results of our work have shown, however,

that the detailed manipulations of the process require infinite care and patience and that there are still many difficulties to be overcome before the process can be labeled "fool-proof." It may be possible to polymerize small-sized samples in several hours, just as it is possible to polymerize a thin film within a matter of minutes, but when dealing with larger, more practical specimens successful polymerization will often require a period of weeks, during which time the process becomes increasingly more difficult. So far, we have also found that only relatively dry materials can be successfully mounted in methyl methacrylate. In some cases where the water content is not excessive it is possible to coat the specimen with gelatin before imbedding, but our results using gelatin for this purpose have not been entirely satisfactory. Attempts to imbed fresh flowers and leaves in methyl methacrylate, using either benzoyl peroxide or sulfur trioxide as the catalyst, have resulted in color loss. Furthermore, iridescent butterflies do not lend themselves readily to the imbedding process, at least not without some sort of protective coating, since such specimens lose their iridescent effect, owing to the fact that this phenomenon is caused by a structural or grating effect and not to the presence of actual pigment. However, unusually attractive and pleasing mounts in methyl methacrylate have been made of such butterflies, by a process which prevents actual contact between the methyl methacrylate and the specimen.

We anticipate that both the Fessenden and the methacrylate mounts of biological materials will possess considerable value for exhibit and other educational purposes and as permanent records of healthy and abnormal specimens. It is highly important, therefore, that the imbedded specimen retain its natural shape, size and color and that the finished mount be free of imperfections, including cloudiness, bubbles, color deterioration and alterations such as "crazing" in the plastic itself.

Until now, the Bureau of Chemistry and Soils has considered premature any announcement as to methods and results of this research project, since many undetermined factors and problems connected with the work remain to be studied and overcome. When the final details and directions for the successful mounting of biological specimens in plastics are worked out, a full and comprehensive report will be forthcoming.

HENRY G. KNIGHT

BUREAU OF CHEMISTRY AND SOILS
U. S. DEPARTMENT OF AGRICULTURE

A HYDRO-AGITATOR FOR SOLUTIONS

SUITABLE agitation of a solution over a period of days for decalcification of bone, etc., is effected by securing a cylindrical half-liter bottle three fourths full of the solution on the hooks in the illustration, so that half the bottle is below the pivotal center. A stream of water at the rate of four gallons an hour tips the pans alternately twice a minute, which we find sufficient to decalcify bone tissue embedded in nitrocellulose blocks, and placed first in a solution of nitric acid followed by a 3 per cent. solution of alum.

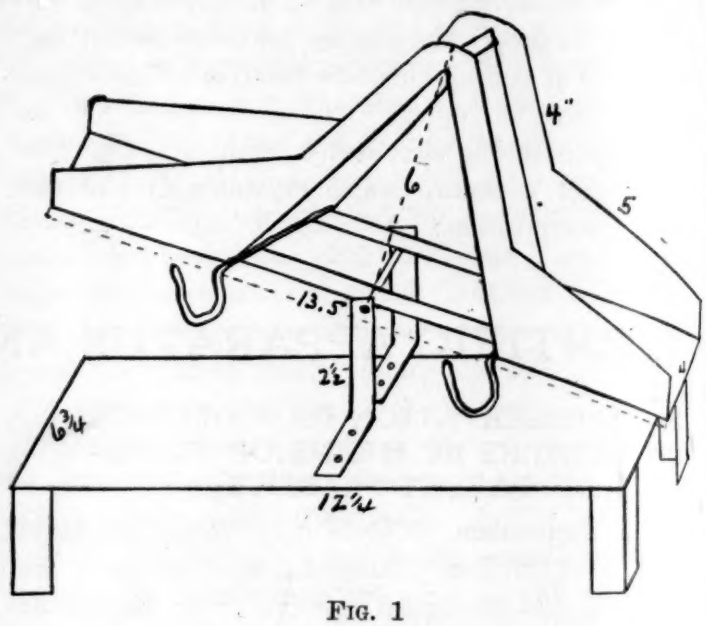

FIG. 1

The table is wood with steel legs, the upright supports for the pivot are steel, and the pans are copper, all scrap material from our shop, constructed in a half day. The apparatus may be made to any scale desired, or the height of the pivot may be increased so as to extend the arc of rotation of the pans. The figures are dimensions in inches.

LEO P. CLEMENTS

DEPARTMENT OF ANATOMY
CREIGHTON MEDICAL SCHOOL

BOOKS RECEIVED

FEIGL, FRITZ. *Qualitative Analysis by Spot Tests.* Translated from the German by Janet W. Matthews. Pp. ix + 400. Nordemann. $7.00.

FINDLAY, ALEXANDER. *A Hundred Years of Chemistry.* Pp. 352. Macmillan. $4.25.

GEIST, OTTO W. and FROELICH G. RAINEY. *Archaeological Excavations at Kukvlik, St. Lawrence Island, Alaska.* Pp. 391. 45 figures. 78 plates. U. S. Government Printing Office, Washington.

GLOCK, WALDO S. *Principles and Methods of Tree-Ring Analysis.* Pp. viii + 100. 44 figures. 14 plates. Carnegie Institution of Washington.

KESTELMAN, H. *Modern Theories of Integration.* Pp. viii + 252. Oxford University Press. $5.50.

MELLON, M. G. *Methods of Quantitative Chemical Analysis.* Pp. ix + 456. 76 figures. Macmillan. $3.00.

SARTON, GEORGE. *The History of Science and the New Humanism.* Pp. xx + 196. Harvard University Press. $2.00.

WHITE, E. GRACE. *A Textbook of General Biology.* Second edition, revised. Pp. 667. 336 figures. Mosby. $3.00.